



UNIVERSITI PUTRA MALAYSIA

**PHYTOCHEMICAL INVESTIGATION AND BIOACTIVITY SCREENING
OF VITEX (*VERBENACEAE*) AND FICUS (*MORACEAE*) SPECIES**

HASSAN ABDALLA ALMAHY DAFALLA

FSAS 2002 7

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OF *VITEX* (VERBENACEAE) AND *FICUS* (MORACEAE) SPECIES**

By

HASSAN ABDALLA ALMAHY DAFALLA

**Thesis Submitted to the School of Graduate Studies, Universiti Putra Malaysia,
in Fulfilment of the Requirements for Degree of Doctor of Philosophy**

February 2002



DEDICATION

TO THE SOUL OF MY FATHER AND BROTHER ALMAHY

TO MY MOTHER

TO MY BROTHER AND SISTERS

TO MY WIFE

TO ALL OF THEM WITH LOVE AND GRATITUDE

Abstract of thesis presented to the Senate of Universiti Putra Malaysia in fulfilment of the requirement for the degree of Doctor of Philosophy

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February 2002

Chairman: Prof. Dr. Mawardi Rahmani

Faculty: Science and Environmental Studies

The study on *Vitex longisepala* involves extraction, various chromatographic methods and structural determination by spectroscopic techniques such as IR, compounds were also elucidated by comparison with the previous works. works on leaves and bark of the plant yielded cholesterol (51), *para*-hydroxybenzoic acid (52), terpene.

Crude extracts and isolated compounds from two parts of this plant were screened for antimicrobial activity using disc diffusion method and cytotoxic activity by using microtitration method. compounds exhibited antimicrobial activity against Gram-positive and Gram-negative bacteria. Cholesterol exhibited significant cytotoxic activity against T-lymphoblastic leukemic cell line with IC₅₀ 10 µg/ml.

not show any antimicrobial activity against fungi. The methanol crude extract of the bark failed to show any significant antimicrobial activity, while the petroleum ether and the chloroform crude extracts of the bark exhibited weak antimicrobial activity against *Bacillus cereus*.

The study on *Vitex quinata* involved the same procedure adopted above. Isolation works on the leaves and bark of the plant yielded cholesterol (51), β -sitosterol (57), *para*-hydroxybenzoic acid (52), fructose (53), glucose (58), catechin (55), quercetin (59) and quercitrin (60). However, the bark of the plant yielded a mixture of long-chain compound, fatty acid and unidentified terpene. The crude extracts and isolated compounds of this plant were tested for antimicrobial and cytotoxic activity using disc diffusion and microtitration methods respectively. The crude extracts and pure isolated compounds exhibited positive antimicrobial results against two bacteria organisms and negative results against four fungi. Cholesterol and β -sitosterol gave cytotoxic activity against T-lymphoblastic leukemic cell line with IC_{50} 10 and 25 μ g/ml respectively.

Detail investigation on the leaves, bark and fruits of *Ficus benjamina* has resulted in the isolation of seven compounds. The structure of these compounds were elucidated by means of spectroscopic methods including by the extensive use of various NMR techniques and also comparison with previous studies. The use of High Field NMR is essential in structural determination of these complex molecules. With

the aids of various NMR experimental techniques and other spectroscopic methods such as IR, UV and MS, the correct structures of the pure isolated compounds were established.

(63),

The presence of bioactive compounds in this plant was detected by the use of antimicrobial organism.

crude plant extracts or pure isolated compounds could be determined.

of chloroform and methanol extracts of the leaves of *Ficus benjamina* gave no significant activity while caffeic acid gave IC₅₀ value of 25 µg/ml.

Phytochemical studies on leaves and bark of *Ficus elastica* have resulted in the isolation of emodin (66),

mannitol (70) together with long-chain fatty acids.

were established based on spectral studies using different spectroscopic methods and on comparison with published data.

Abstrak tesis yang dikemukakan kepada Senat Universiti Putra Malaysia sebagai memenuhi keperluan memperoleh ijazah Doktor Falsafah

**PENYIASATAN FITOKIMIA DAN SARINGAN BIOAKTIVITI *VITEX*
(*VERBENACEAE*) DAN *FICUS* (*MORACEAE*) SPESIES**

Oleh

HASSAN ABDALLA ALMAHY DAFALLA

Februari 2002

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Kajian tentang *Vitex longisepala* dijalankan dengan melakukan pengekstrakan, pemencilan menggunakan kaedah kromatografi dan penentuan struktur melalui teknik spektroskopi seperti IR, NMR termasuk 2D-NMR dan MS. Struktur sebatian telah juga diuraikan secara perbandingan dengan kajian sebelum ini. Pemencilan terhadap daun dan kulit tumbuhan menghasilkan kolesterol (51), asid parahidroksibenzoik (52), fruktosa (53), xilosa (54), katekin (55), genestein (56) dan terpena yang tidak dikenali.

Ekstrak mentah dan sebatian yang dipencilkan daripada dua bahagian tumbuhan ini telah dikesan aktiviti antimikrob dengan menggunakan kaedah peresapan cakera dan aktiviti sitotoksik menggunakan kaedah mikropentitratan. Ekstrak mentah daun dan sebatian tulen yang dipencilkan memperlihatkan aktiviti

antimikrob menentang bakteria Gram-positif dan Gram-negatif. Kolesterol menunjukkan aktiviti sitotoksik yang signifikan menentang sel leukemia T-limfoblas dengan IC₅₀ 10 µg/ml.

Walau bagaimanapun semua sebatian tidak menunjukkan sebarang aktiviti antimikrob menentang kulat.

antimikrob yang signifikan,

mentah kloroform kulit menunjukkan aktiviti antimikrob yang lemah terhadap *Bacillus cereus*.

Kajian terhadap *Vitex quinata* melibatkan prosedur yang sama yang telah digunakan di atas. Kajian pemenciran daun dan kulit tumbuhan menghasilkan kolesterol (51),

glukosa (58),

kulit tumbuhan menghasilkan campuran asid lemak berantai panjang dan terpena yang tidak dikenali.

mendapatkan aktiviti antimikrob dan sitotoksik dengan menggunakan kaedah peresapan cakera dan mikropentitratan.

Ekstrak mentah dan sebatian tulen menunjukkan keputusan antimikrob positif terhadap dua bakteria dan keputusan negatif terhadap empat kulat.

dan β -sitosterol memberi aktiviti sitotoksik terhadap sel leukemia T-limfoblas dengan nilai IC_{50} masing-masing 10 dan 25 $\mu\text{g/ml}$.

Kajian mendalam terhadap daun, kulit dan buah *Ficus benjamina* telah menghasilkan tujuh komponen. Struktur komponen ini telah diuraikan dengan menggunakan kaedah spektroskopi termasuk pelbagai teknik NMR dan juga perbandingan dengan kajian lampau. Penggunaan NMR Medan Tinggi adalah penting dalam penentuan struktur molekul yang kompleks. Dengan bantuan pelbagai teknik eksperimen NMR dan kaedah spektroskopi lain seperti IR, UV dan MS, struktur sebatian yang dipencil tulen dapat dipastikan sebagai asid sinamik (61), laktosa (62), naringenin (63), quersetin (59), asid kafeik (64) dan stigmasterol (65).

Kehadiran sebatian bioaktif dalam tumbuh-tumbuhan ini telah dikesan dengan menggunakan organisma antimikrob. Dengan bantuan sistem biocerakinan ini aktiviti ekstrak tumbuhan mentah atau sebatian tulen dapat dipastikan. Nilai IC_{50} ekstrak kloroform dan etanol daun *Ficus benjamina* tidak memberikan aktiviti yang signifikan sementara asid kafeik mempunyai nilai IC_{50} sebanyak 25 $\mu\text{g/ml}$.

Kajian fitokimia terhadap daun dan kulit tumbuhan ini telah menghasilkan emodin (66), sukrosa (67), laktosa (62), morin (68), rutin (69) dan D-manitol (70) bersama dengan asid lemak berantai panjang. Struktur sebatian ini dipastikan

berasaskan kajian menggunakan pelbagai kaedah spektroskopi dan perbandingan dengan data yang telah diterbitkan.

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I certify that an Examination Committee met on 5th February 2002 to conduct the final examination of Hassan Abdalla Almahy Dafalla on his Doctor of Philosophy thesis entitled "Phytochemical Investigation and Bioactivity Screening of *Vitex* (Verbenaceae) and *Ficus* (Moraceae) Species" in accordance with Universiti Pertanian Malaysia (Higher Degree) Act 1980 and Universiti Pertanian Malaysia (Higher Degree) Regulations 1981. The Committee recommends that the candidate be awarded the relevant degree. Members of the Examination Committee are as follows:

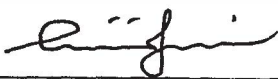
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I hereby declare that the thesis is based on my original work except for quotations and citations which have been duly acknowledged. I also declare that it has not been previously or concurrently submitted for any other degree at UPM or other institutions.

Hassan Abdalla Almahy Dafalla

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Date: 22.02.2002

TABLE OF CONTENTS

	Page
DEDICATION.....	2
ABSTRACT	3
ABSTRAK	6
ACKNOWLEDGEMENTS.....	10
APPROVAL SHEETS.....	12
DECLARATION FORM.....	14
LIST OF TABLES	19
LIST OF FIGURES	20
LIST OF ABBREVIATIONS	25

SECTION A

CHAPTER

I	INTRODUCTION.....	30
	Natural Products Research in Malaysia.....	30
	Isolation of Biologically Active Compounds from Higher Plant.....	33
	<i>Vitex</i> Species in Malaysia.....	34
	Medicinal Uses of <i>Vitex</i>	35
	<i>Ficus</i> Species in Malaysia	36
	Medicinal Uses of <i>Ficus</i>	37
	Objectives of the Present Work.....	38
II	LITERATURE REVIEW.....	39
	Previous Work Done on the Genus <i>Vitex</i> and <i>Ficus</i>	39
III	EXPERIMENTAL.....	63
	General Material and Methods.....	63
	Melting Point.....	63
	Optical Rotation.....	63
	Chromatographic Methods.....	63
	Thin Layer Chromatography.....	64
	Preparative Thin Layer Chromatography.....	65
	Infrared Spectroscopy Determination.....	65
	Ultra-Violet Visible Spectroscopy Determination.....	66
	Nuclear Magnetic Resonance.....	66
	Mass Spectroscopy.....	66
	Plant Material.....	67
	Method of Extraction.....	67



Examination of Extracts by Thin Layer Chromatography.....	70
Compounds Isolated from <i>Vitex longisepala</i>	70
Isolation of Cholesterol (51).....	70
Isolation of <i>para</i> -hydroxybenzoic acid (52).....	71
Isolation of Unidentified Terpene.....	72
Isolation of Fructose (53).....	73
Isolation of Xylose (54).....	74
Isolation of Catechin (55).....	75
Isolation of Genistein (56).....	76
Compounds Isolated from <i>Vitex quinata</i>	77
Isolation of Cholesterol (51).....	77
Isolation of β -sitosterol (57).....	77
Isolation of <i>para</i> -hydroxybenzoic acid (52).....	78
Isolation of Fructose (53).....	79
Isolation of Glucose (58).....	79
Isolation of Catechin (55).....	80
Isolation of Quercetin (59).....	80
Isolation of Quercitrin (60).....	81
Extraction and Isolation of Compounds from <i>Ficus benjamina</i> and <i>Ficus elastica</i>	83
Plant Material.....	83
Method of Extraction.....	83
Compounds Isolated from <i>Ficus benjamina</i>	85
Isolation of Cinnamic acid (61).....	85
Isolation of Lactose (62).....	86
Isolation of Naringenin (63).....	87
Isolation of Quercetin (59).....	88
Isolation of Caffeic acid (64).....	88
Isolation of Stigmasterol (65).....	89
Compounds Isolated from <i>Ficus elastica</i>	91
Isolation of Emodin (66).....	91
Isolation of Sucrose (67).....	92
Isolation of Lactose (62).....	93
Isolation of Morin (68).....	93
Isolation of Rutin (69).....	94
Isolation of D-Mannitol (70).....	95
 IV RESULTS AND DISCUSSIONS.....	 97
Extraction and Isolation of Chemical Constituents from <i>Vitex</i> Species.....	97
Characterisation of Compounds Isolated from <i>Vitex longisepala</i> ..	99
Cholesterol (51).....	99
<i>para</i> -hydroxybenzoic acid (52).....	105
Fructose (53).....	110

Xylose (54).....	114
Catechin (55).....	121
Genistein (56).....	128
Characterisation of Compounds Isolated from <i>Vitex quinata</i>	135
Cholesterol (51).....	135
β -sitosterol (57).....	135
<i>para</i> -hydroxybenzoic acid (52).....	140
Fructose (53).....	140
Glucose (58).....	140
Catechin (55).....	145
Quercetin (59).....	145
Quercitrin (60).....	153
Extraction and Isolation of Chemical Constituents from	
<i>Ficus</i> Species.....	160
Characterisation of Compounds Isolated from <i>Ficus benjamina</i> ...	161
Cinnamic acid (61).....	161
Lactose (62).....	165
Naringenin (63).....	170
Quercetin (59).....	177
Caffeic acid (64).....	177
Stigmasterol (65).....	182
Characterisation of Compounds Isolated from <i>Ficus elastica</i>	187
Emodin (66).....	187
Sucrose (67).....	192
Lactose (62).....	196
Morin (68).....	196
Rutin (69).....	202
D-Mannitol (70).....	209
V CONCLUSION	214
SECTION B	
BIOASSAY	216
Introduction.....	216
Bioactive of Natural Products.....	217
Materials and Methods.....	219
Preparation of Stock Cultures.....	219
Preparation of Assay Media.....	219
Cultivation of Bacterial Isolates for Antimicrobial	
Assay.....	220
Results and Discussions.....	221
Conclusion.....	226
Studies on the Cytotoxicity Against (CEM-SS) Cell Line.....	227
Introduction.....	227

Materials and Methods.....	229
Cell Lines.....	229
Assay Media.....	229
Cultivation of CEM-SS Cell Line.....	229
Cytotoxic Assay.....	230
Results and Discussions.....	231
Conclusion.....	236
BIBLIOGRAPHY.....	237
APPENDICES	
Appendix A.....	253
Appendix B.....	255
Appendix C.....	257
Appendix D.....	258
BIODATA OF THE AUTHOR.....	260

LIST OF TABLES

Table		Page
1	The extracts of the leaves and bark of <i>Vitex longisepala</i>	69
2	The extracts of the leaves and bark of <i>Vitex quinata</i>	69
3	Solvent system for TLC.....	257
4	The extracts of the leaves, bark and fruits of <i>Ficus benjamina</i>	84
5	The extracts of the leaves and bark of <i>Ficus elastica</i>	84
6	Antimicrobial activity of compounds isolated from <i>Vitex longisepala</i> against bacteria and fungi	222
7	Antimicrobial activity of compounds isolated from <i>Vitex quinata</i> against bacteria and fungi	223
8	Antimicrobial activity of compounds isolated from <i>Ficus benjamina</i> against bacteria and fungi	224
9	Antimicrobial activity of compounds isolated from <i>Ficus elastica</i> against bacteria and fungi	225

LIST OF FIGURES

Figure		page
1	Extraction, isolation and bioassay procedures.....	68
2	Infrared spectrum of cholesterol.....	101
3	¹ H-NMR spectrum of cholesterol.....	102
4	¹³ C-NMR spectrum of cholesterol	102
5	DEPT spectrum of cholesterol.....	103
6	Mass spectrum of cholesterol.....	104
7	Infrared spectrum of <i>para</i> -hydroxybenzoic acid	107
8	¹ H-NMR spectrum of <i>para</i> -hydroxybenzoic acid.....	108
9	¹³ C-NMR spectrum of <i>para</i> -hydroxybenzoic acid	108
10	Mass spectrum of <i>para</i> -hydroxybenzoic acid.....	109
11	Infrared spectrum of fructose.....	111
12	¹ H-NMR spectrum of fructose.....	112
13	¹³ C-NMR spectrum of fructose.....	112
14	Mass spectrum of fructose.....	113
15	Infrared spectrum of xylose.....	116
16	¹ H-NMR spectrum of xylose.....	117
17	¹³ C-NMR spectrum of xylose.....	117
18	DEPT spectrum of xylose.....	118
19	COSY spectrum of xylose.....	119

20	Mass spectrum of xylose.....	120
21	Infrared spectrum of catechin.....	123
22	¹ H-NMR spectrum of catechin.....	124
23	¹³ C-NMR spectrum of catechin.....	124
24	DEPT spectrum of catechin.....	125
25	COSY spectrum of catechin.....	126
26	Mass spectrum of catechin.....	127
27	Infrared spectrum of genistein	130
28	¹ H-NMR spectrum of genistein	131
29	¹³ C-NMR spectrum of genistein.....	132
30	DEPT spectrum of genistein	133
31	Mass spectrum of genistein	134
32	Infrared spectrum of β -sitosterol	137
33	¹ H-NMR spectrum of β -sitosterol	138
34	¹³ C-NMR spectrum of β -sitosterol	138
35	Mass spectrum of β -sitosterol	139
36	Infrared spectrum of glucose.....	142
37	¹ H-NMR spectrum of glucose.....	143
38	¹³ C-NMR spectrum of glucose.....	143
39	Mass spectrum of glucose	144
40	Infrared spectrum of quercetin.....	148
41	¹ H-NMR spectrum of quercetin.....	149

42	¹³ C-NMR spectrum of quercetin	149
43	DEPT spectrum of quercetin	150
44	COSY spectrum of quercetin	151
45	Mass spectrum of quercetin	152
46	Infrared spectrum of quercitrin..	155
47	¹ H-NMR spectrum of quercitrin.....	156
48	¹³ C-NMR spectrum of quercitrin.....	156
49	DEPT spectrum of quercitrin.....	157
50	COSY spectrum of quercitrin	158
51	Mass spectrum of quercitrin.....	159
52	Infrared spectrum of cinnamic acid.....	162
53	¹ H-NMR spectrum of cinnamic acid.....	163
54	¹³ C-NMR spectrum of cinnamic acid.....	163
55	Mass spectrum of cinnamic acid.....	164
56	Infrared spectrum of lactose	167
57	¹ H-NMR spectrum of lactose	168
58	¹³ C-NMR spectrum of lactose	168
59	Mass spectrum of lactose	169
60	Infrared spectrum of naringenin	172
61	¹ H-NMR spectrum of naringenin	173
62	¹³ C-NMR spectrum of naringenin	173
63	DEPT spectrum of naringenin.....	174

64	COSY spectrum of naringenin	175
65	Mass spectrum of naringenin.....	176
66	Infrared spectrum of caffeic acid	179
67	¹ H-NMR spectrum of caffeic acid	180
68	¹³ C-NMR spectrum of caffeic acid.....	180
69	Mass spectrum of caffeic acid.....	181
70	Infrared spectrum of stigmasterol.....	184
71	¹ H-NMR spectrum of stigmasterol.....	185
72	¹³ C-NMR spectrum of stigmasterol.....	185
73	Mass spectrum of stigmasterol.....	186
74	Infrared spectrum of emodin	189
75	¹ H-NMR spectrum of emodin	190
76	¹³ C-NMR spectrum of emodin	190
77	Mass spectrum of emodin	191
78	Infrared spectrum of sucrose	193
79	¹ H-NMR spectrum of sucrose	194
80	¹³ C-NMR spectrum of sucrose	194
81	Mass spectrum of sucrose	195
82	Infrared spectrum of morin	198
83	¹ H-NMR spectrum of morin.....	199
84	¹³ C-NMR spectrum of morin.....	199
85	DEPT spectrum of morin.....	200

86	Mass spectrum of morin.....	201
87	Infrared spectrum of rutin.....	204
88	¹ H-NMR spectrum of rutin.....	205
89	¹³ C-NMR spectrum of rutin.....	205
90	DEPT spectrum of rutin.....	206
91	COSY spectrum of rutin.....	207
92	Mass spectrum of rutin.....	208
93	Infrared spectrum of D-mannitol.....	211
94	¹ H-NMR spectrum of D-mannitol.....	212
95	¹³ C-NMR spectrum of D-mannitol.....	212
96	Mass spectrum of D-mannitol.....	213
97	Inhibition zones of catechin and genistein against <i>Bacillus cereus</i> and <i>Pseudomonas aeruginosa</i>	222
98	Percentage viability of (CEM-SS) cells after treated with different concentration of cholesterol.....	231
99	Percentage viability of (CEM-SS) cells after treated with different concentration of β -sitosterol.....	232
100	Morphology of (CEM-SS) cells line treated with (a) 30 μ g/ml of cholesterol (b) 15 μ g/ml of β -sitosterol for 72 hours (c) control ..	233
101	Percentage viability of (CEM-SS) cells after treated with different concentration of caffeic acid	234
102	Morphology of (CEM-SS) cells line treated with (a) 15 μ g/ml of caffeic acid for 72 hours (b) control	235